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## **Physics of arcing, and implications to sputter deposition**

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## **Physics of arcing, and implications to sputter deposition**

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### Abstract

Arcing is a well-known, unwanted discharge regime observed on the surface of sputtering targets. The discharge voltage breaks down to less than 50 V while the current jumps to elevated levels. Arcing is unwanted because it prevents uniform deposition and creates particulates. The issue of arcing has been dealt with by target surface conditioning and by using modern power supplies that have arc suppression incorporated. With increasing quality requirements in terms of uniformity of coatings, and absence of particulates, especially for electrochromic and other advanced coatings applications, the issue of arcing warrants a closer examination with the goal to find other, physics-based, and hopefully better approaches of arcing prevention. From a physics point of view, the onset of arcing is nothing else than the transition of the discharge to a cathodic arc mode, which is characterized by the ignition of non-stationary arc spots. Arc spots operate by a sequence of microexplosions, enabling explosive electron emission, as opposed to secondary electron emission. Arc spots and their fragments have a size distribution in the micrometer and sub-micrometer range, and a characteristic time distribution that has components shorter than microseconds. Understanding the ignition conditions of arc spots are of central physical interest. Spot ignition is associated with electric field enhancement, which can be of geometric nature (roughness, particles), or chemical nature (e.g. oxide formation) and related local accumulation of surface charge. Therefore, it is clear that these issues are of particular concern when operating with high-density plasmas, such as in high-power pulsed sputtering, and when using reactive sputter gases.

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